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COPY #6

PROGRAM 698 BJ
SYSTEM REVIEW

18 Sept 62

ORIGINAL SPECIFICATIONS

TECHNICAL WORK STATEMENT OF 8 AUGUST 1960

REQUIREMENT:

- ORBITAL PHOTO RECONNAISSANCE SYSTEM WITH HIGH ACUITY CAMERA, LARGE AREA COVERAGE, SHORT LIFE, RELIABLE RE-ENTRY AND ACCURATE RECOVERY IN ZI

PERFORMANCE:

- 1.1×10^6 NM^2 PER DAY; 9×10^6 NM^2 TOTAL COVERAGE
- 10 FOOT RESOLUTION AT 2:1 CONTRAST
- 120 TO 200 N.M. ALTITUDE
- SHORTEST POSSIBLE OPERATIONAL LIFE-5 DAYS DESIRABLE
- PRINCIPAL POINT LOCATION TO ONE NAUTICAL MILE
- RECOVERY IN CONTINENTAL U.S., 5 N.M. C.E.P.

OPTIMAL SCHEDULE

- FIRST LAUNCH DECEMBER 61.
- TOTAL OF SEVEN LAUNCHES AT FORTY DAY INTERVALS
- OPTION OF TWO AMBIGUOUS FLIGHTS.
- EXTENSION OF PROPOSAL SUBMISSION DUE TO REVISED PAYLOAD RESOLUTION
- SCHEDULE TO 9 MARCH 62.

DESIGN CONSIDERATIONS

SPECIFIED LIMITATIONS:

- RE-ENTRY, RECOVERY SYSTEM MUST BE SIGNIFICANT IMPROVEMENT
- MAXIMUM USE OF EXISTING FACILITIES AND FLIGHT PROVEN EQUIPMENT
- RELIABILITY PRIME CONSIDERATION, EARLY CAPABILITY NEXT MOST IMPORTANT
- ASCENT VEHICLE WILL BE ATLAS/AGENA B OR ATLAS ALONE

OPTIONS:

- SELECTION OF LANDING AREA WITHIN THE UNITED STATES
- USE OF AGENA B FOR ATTITUDE CONTROL, SECONDARY POWER, TELEMETRY AND COMMAND, RETRO IMPULSE
- STEREOPHOTOGRAPHY DESIRABLE
- THOR/AGENA COMPONENT TEST FLIGHTS – UP TO 5
- PIGGY-BACK FLIGHTS WITH BALLISTIC SYSTEM TESTS

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SELECTED SYSTEM CONFIGURATION

SELECTED PAYLOAD CONFIGURATION

- TWO 36 INCH FOCAL LENGTH CAMERAS (180° STEREO)
- CAMERA ORIENTED NEAR VERTICAL (FOLDED OPTICS)
- IR TAPE SPOOLERS
- TRUSS TYPE STRUCTURE
- SINGLE WINDOW
- INDEPENDENT CAMERA OPERATION
- SEPTUM CUTTERS AND SEALS
- 12,000 FEET OF 4.5 INCH WIDE FILM (50/52)

5

SELECTED RE-ENTRY VEHICLE CONFIGURATION

BALLISTIC VEHICLE

- RVX-2 PROVEN AERODYNAMICALLY SIMILAR (9° SPHERE CONE)
- LESS THERMAL PROTECTION, LOWER WEIGHT THAN MANEUVERABLE VEHICLE
- ABLATION TYPE-G.E. CENTURY SERIES

NEW MAJOR SUBSYSTEMS

- RECOVERY POWER, TELEMETRY AND PROGRAMMING
- FILM CASSETTE
- RECOVERY PACKAGE
- DESTRUCT SYSTEM-THERMITE TYPE

SEPARATION

- EXPLOSIVE BOLTS

MAJOR CONSIDERATIONS
PROPOSED COMMAND & CONTROL
TRACKING
COMMAND
TELEMETRY
TRACKING STATIONS

[illegible] OF LAND RECOVERY

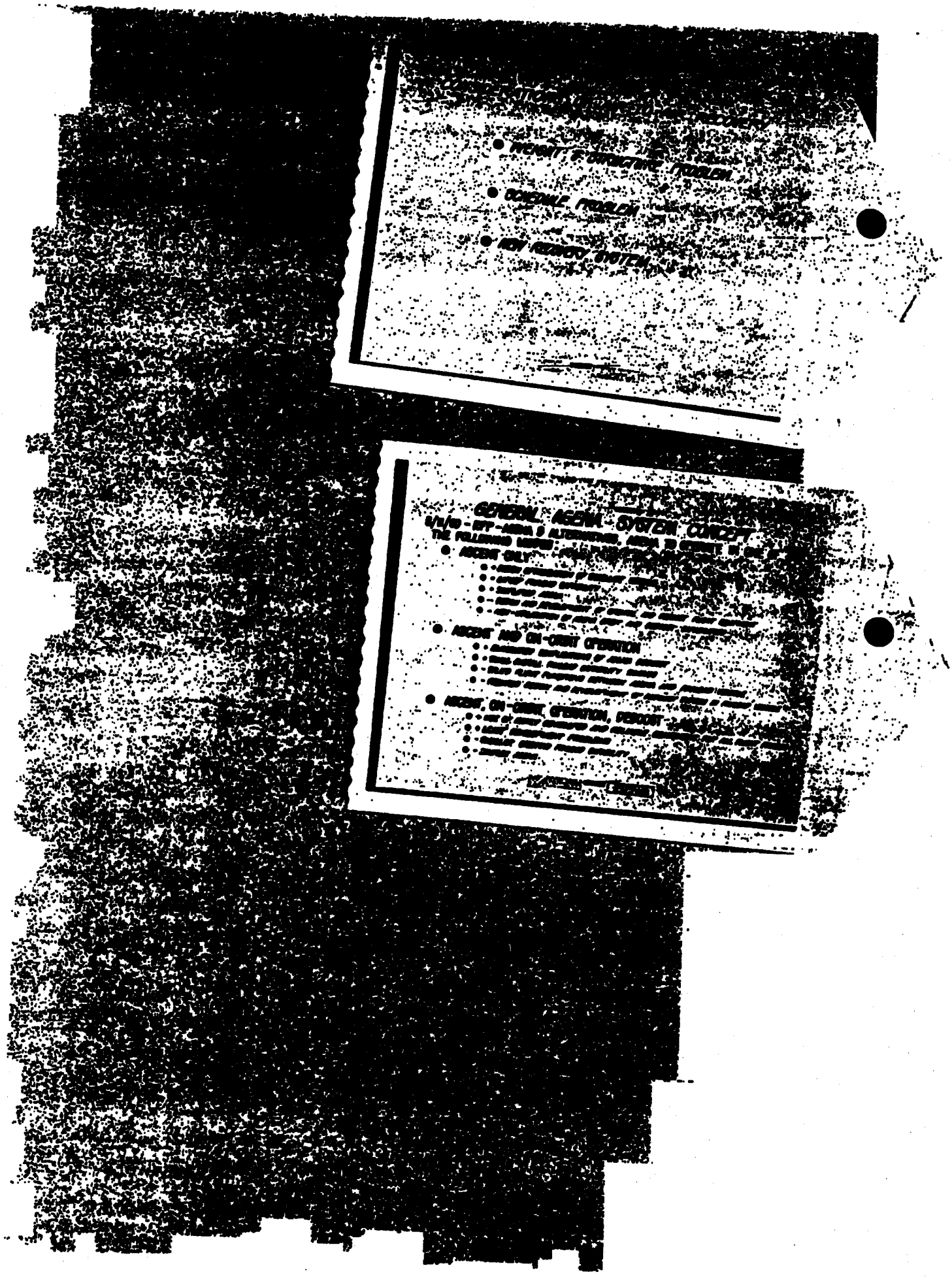
- REQUIREMENTS
  - SMALL DEP
  - SOLUTION TO ACIDIC PROBLEM
- SOLUTION
  - SCRUBBER ROBUST - REJECTED DUE TO DEVELOPMENT AND SCHEDULE PROBLEMS

8

CONSIDERATIONS OF SIMPLIFIED COMMAND SYSTEM

DISCOVERER COMMAND SYSTEM UNUSEABLE BECAUSE:

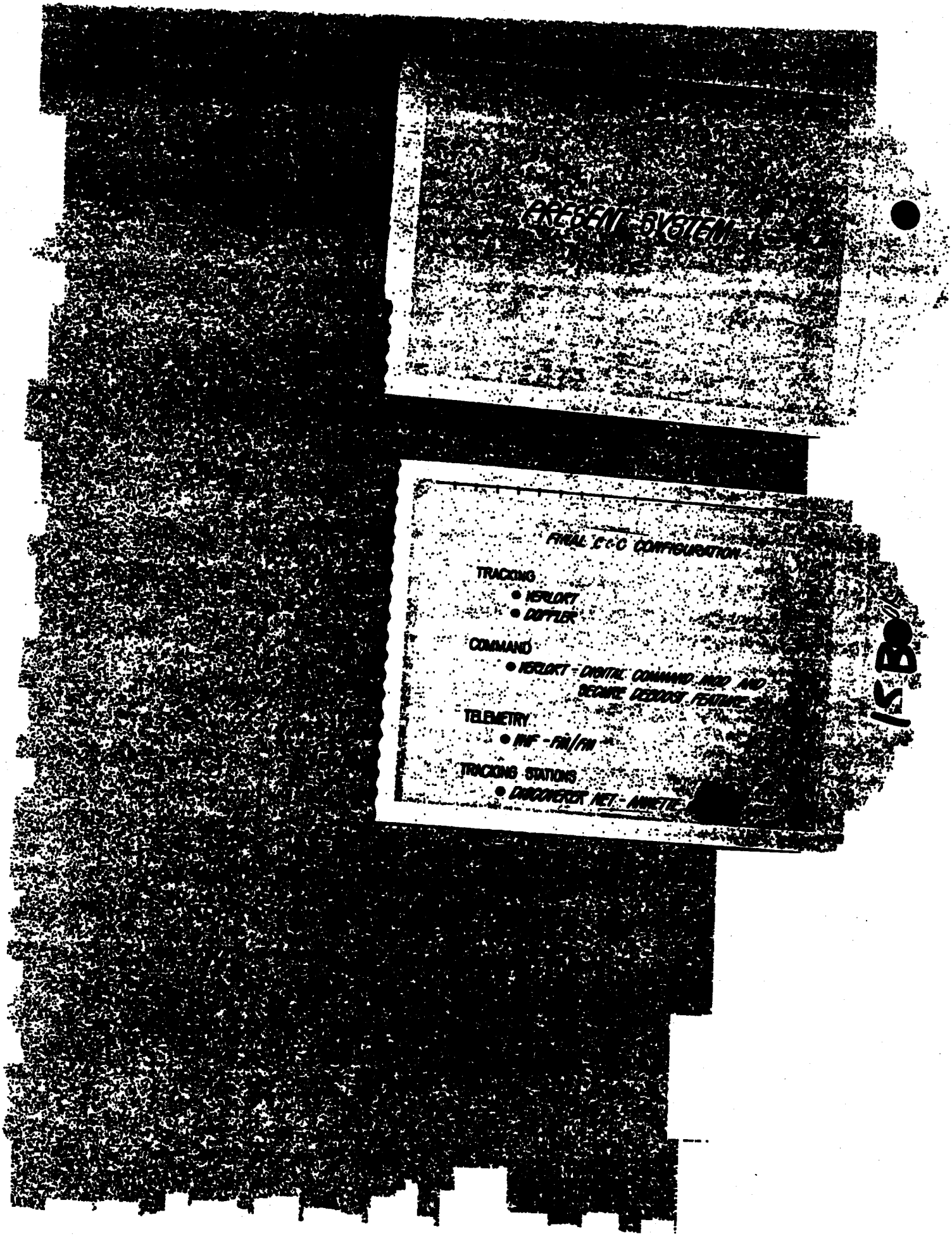
- INABILITY TO CHANGE STORED PROGRAM
- LIMITED STORED PROGRAM CAPACITY
- OVER-TARGET COMMAND DEFICIENCY (OTC)
- TIMER INACCURACY FOR ULTIMATE LAND RECOVERY
- SECURITY DEFICIENCY

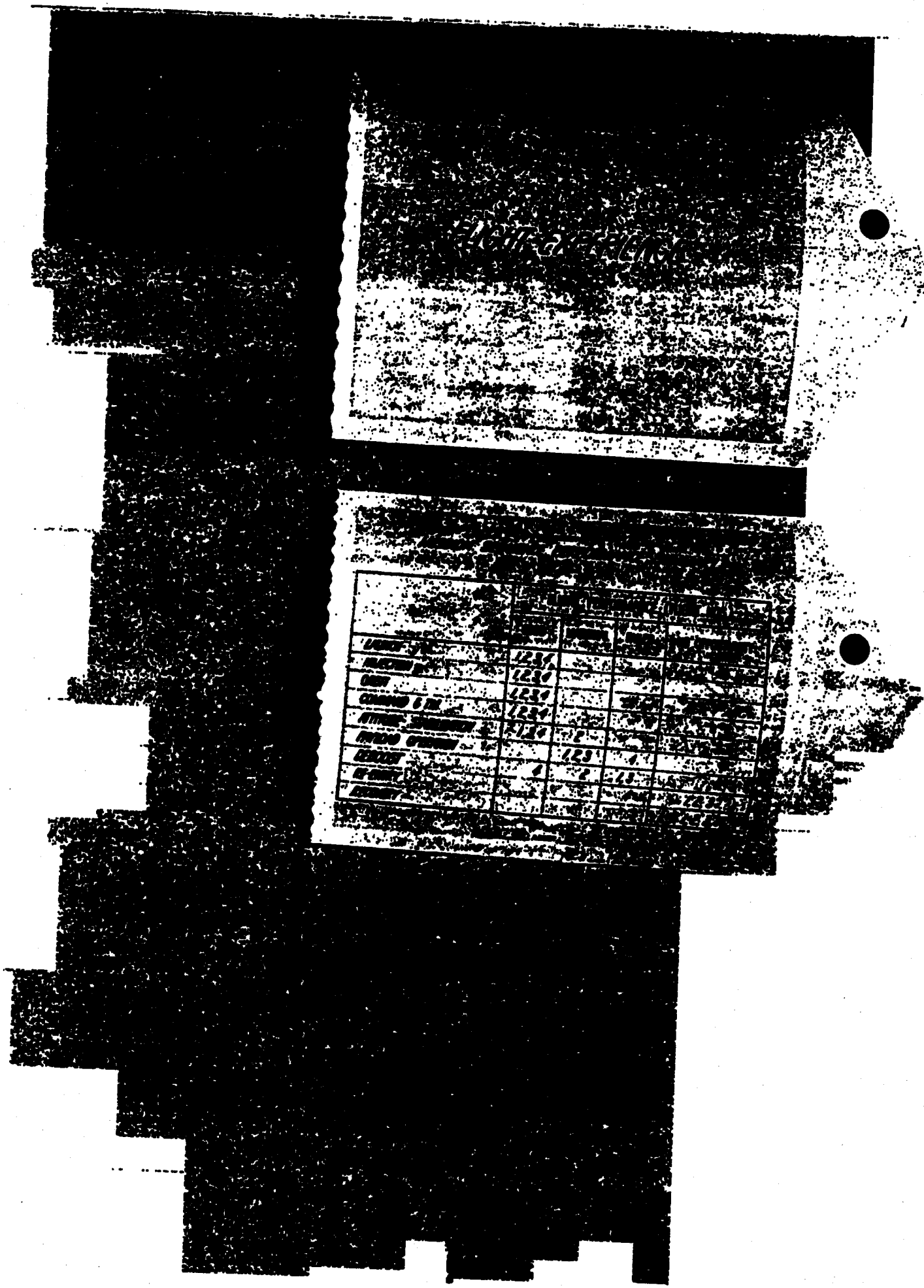


SIGNIFICANT DEVIATIONS FROM SELECTED DESIGN
RE-ENTRY VEHICLE

- SPIN AND DETONATION - CHANGED TO SPIN SPRINGS & SHAPED CHARGE
- STRUCTURE - SECTIONS INCREASED FROM THREE TO FOUR
- THERMAL - SHIELD CHANGED FROM SINGLE MATERIAL TO PHENOLIC NYLON

  NOSE & FRUSTRUM MADE OF GE 124-A TRANSPARENT PLASTIC
- LIGHTENED STRUCTURE
- RECOVERY (LAND & WATER)
- DESTRUCT SYSTEM REMOVED


PRESENT SYSTEM
FINAL C&C CONFIGURATION
TRACKING
• KERLOFT
• DOPPLER
COMMAND
• KERLOFT - DIGITAL COMMAND AND
SECURE DECODER FEATURE
TELEMETRY
• PAF - PM/FM
TRACKING STATIONS
• DISCOVERER NET - ANNETTE



MISSION SUMMATION SUBSYSTEM PERFORMANCE

MISSION NO	ATLAS	AGENA B	[illegible]	[illegible]	[illegible]	C&C*
I	OK	NG [illegible]	OK	70%	NA	OK
II	OK	OK	NG [illegible]	75%	NA	OK
III	OK	NG [illegible]	OK	78%	NA	OK
IV	OK	OK	OK	25%	NG [illegible]	OK

NOTES: - *C&C COVERS GROUND STATION AS WELL AS COMMAND SYSTEM OPERATION
NG - FORMS MISSION FAILURE
NA - SYSTEM NOT ACTIVATED

FIRST FLIGHT EXPERIENCE
(AGENA 240)

PROBLEM	CAUSE	FIX
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

FIRST FLIGHT EXPERIENCE
(PAYLOAD VEHICLE 651)

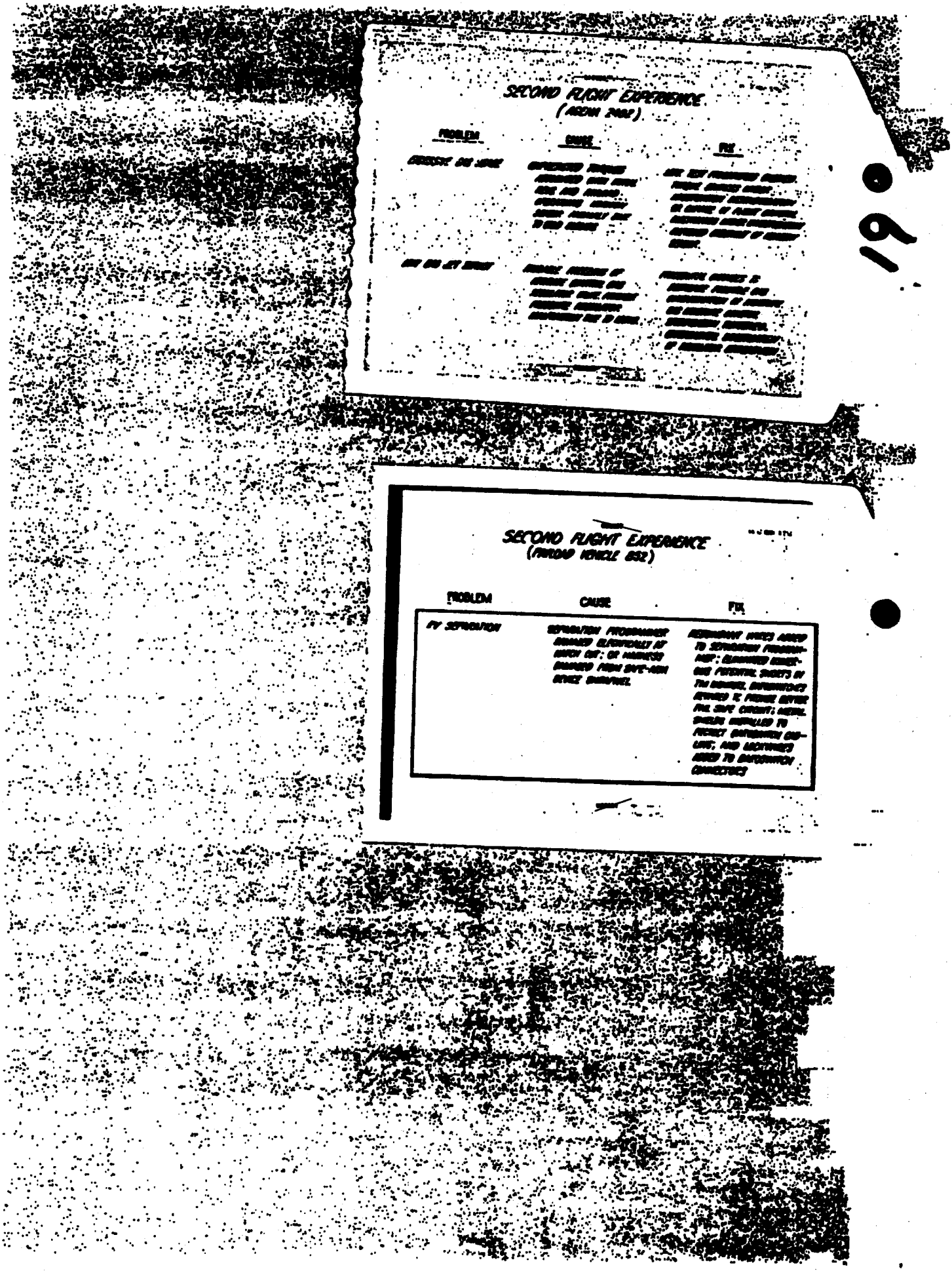
PROBLEM	CAUSE	FIX
UHF DOPPLER BEACON DROP OUT ON PCM II AT ATS	LOSS OF LOCK-ON OR BEACON POWER SUPPLY	MODIFICATION OF TRACKING SYS PERFORMANCE AND RELIABILITY INVESTIGATION OF UHF BEACON SYSTEM

17

FIRST FLIGHT EXPERIENCE
(PAYLOAD - FM #1)

PROBLEM	CAUSE	FIX
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

18


SECOND FLIGHT EXPERIENCE
(ARIOM 2002)
PROBLEM
CAUSE
FIX
SECOND FLIGHT EXPERIENCE
(FAILED VEHICLE 852)
PROBLEM
CAUSE
FIX
FF SEPARATION

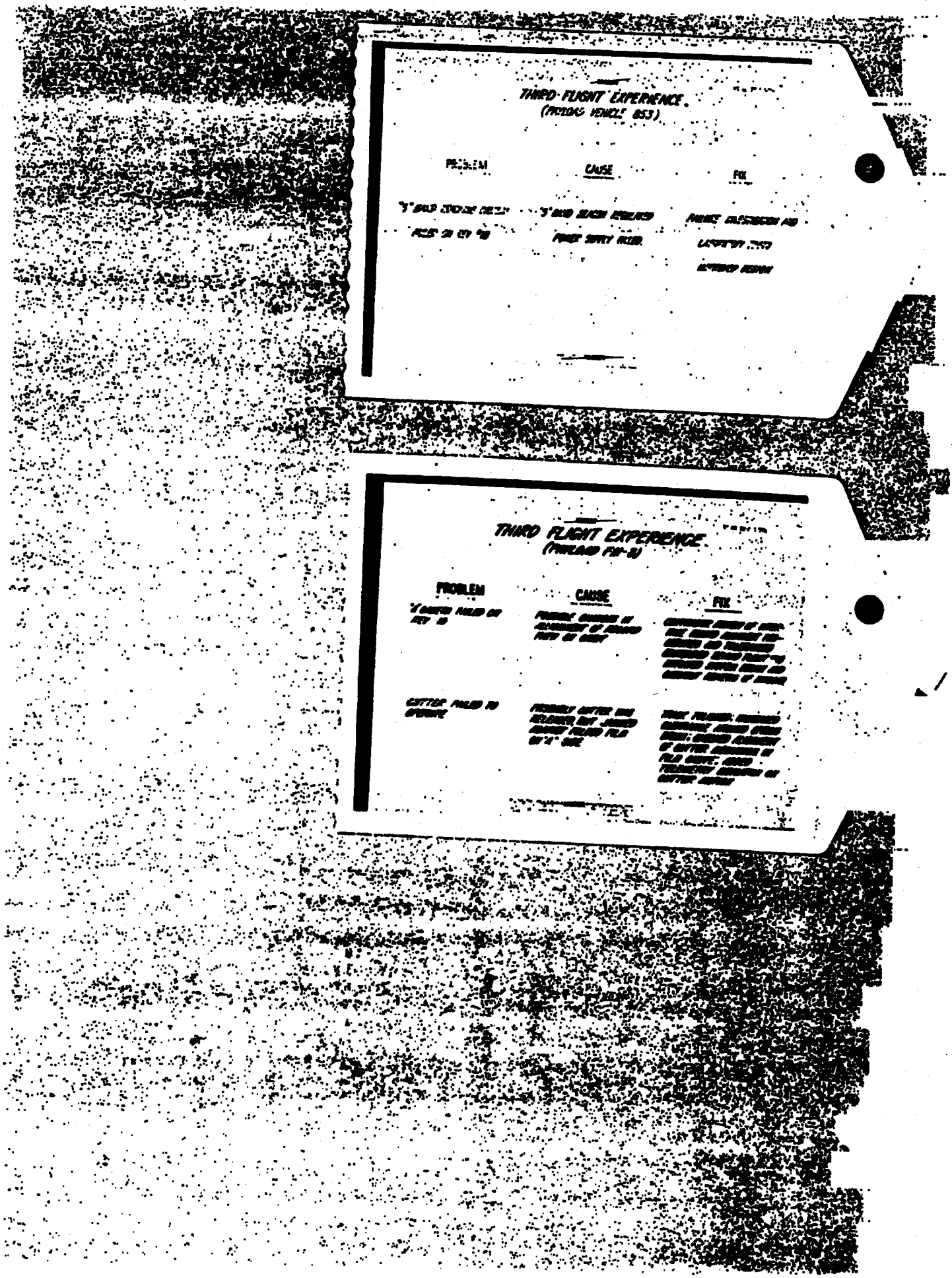
SECOND FLIGHT EXPERIENCE
(PAYLOAD FM #2)

PROBLEM	CAUSE	FIX
"B" CAMERA FAILED ON REV 8	TELEMETRY MONITOR POINT FAILURE SUSPECTED TRANSPORT OR ELECTRICAL FAILURE SUSPECTED	[illegible]
CUTTER TELEMETRY FAILURE AT 8-12 HOURS MIDDLE TO OBSERVE CUTTER ACTION	CHOTE SEAL DOOR TELEMETRY MICROSWITCH MALADJUSTED	IMPROVED T/M CHECK OUT PROCEDURE

21

THIRD FLIGHT EXPERIENCE
(AGENA 2403)

PROBLEM	CAUSE	FIX
NO ULLAGE DURING DEBOOST	SHORT IN SPS VALVE CIRCUITRY PROHIBITED BOTH SPS AND SOLID ULLAGE ROCKET FROM OPERATING	REDESIGNED CIRCUITRY TO COMPLETELY SEPARATE SPS FROM SOLID ULLAGE ROCKET. IMPROVED PREFLIGHT CHECKOUT OF CIRCUITRY

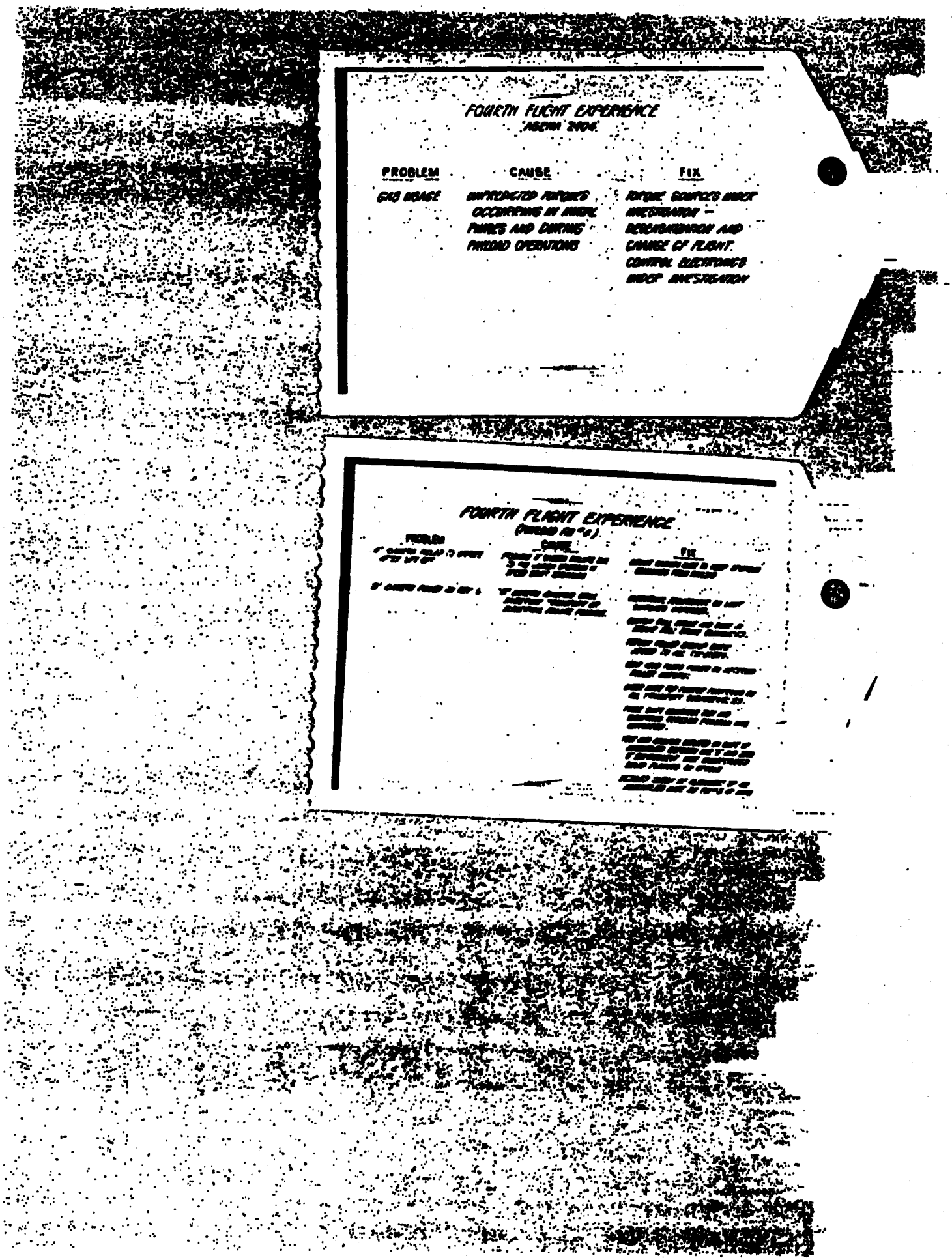


THIRD FLIGHT EXPERIENCE
(PAYLOAD VEHICLE 853)

PROBLEM | CAUSE | FIX

THIRD FLIGHT EXPERIENCE
(PAYLOAD FW-4)

PROBLEM | CAUSE | FIX

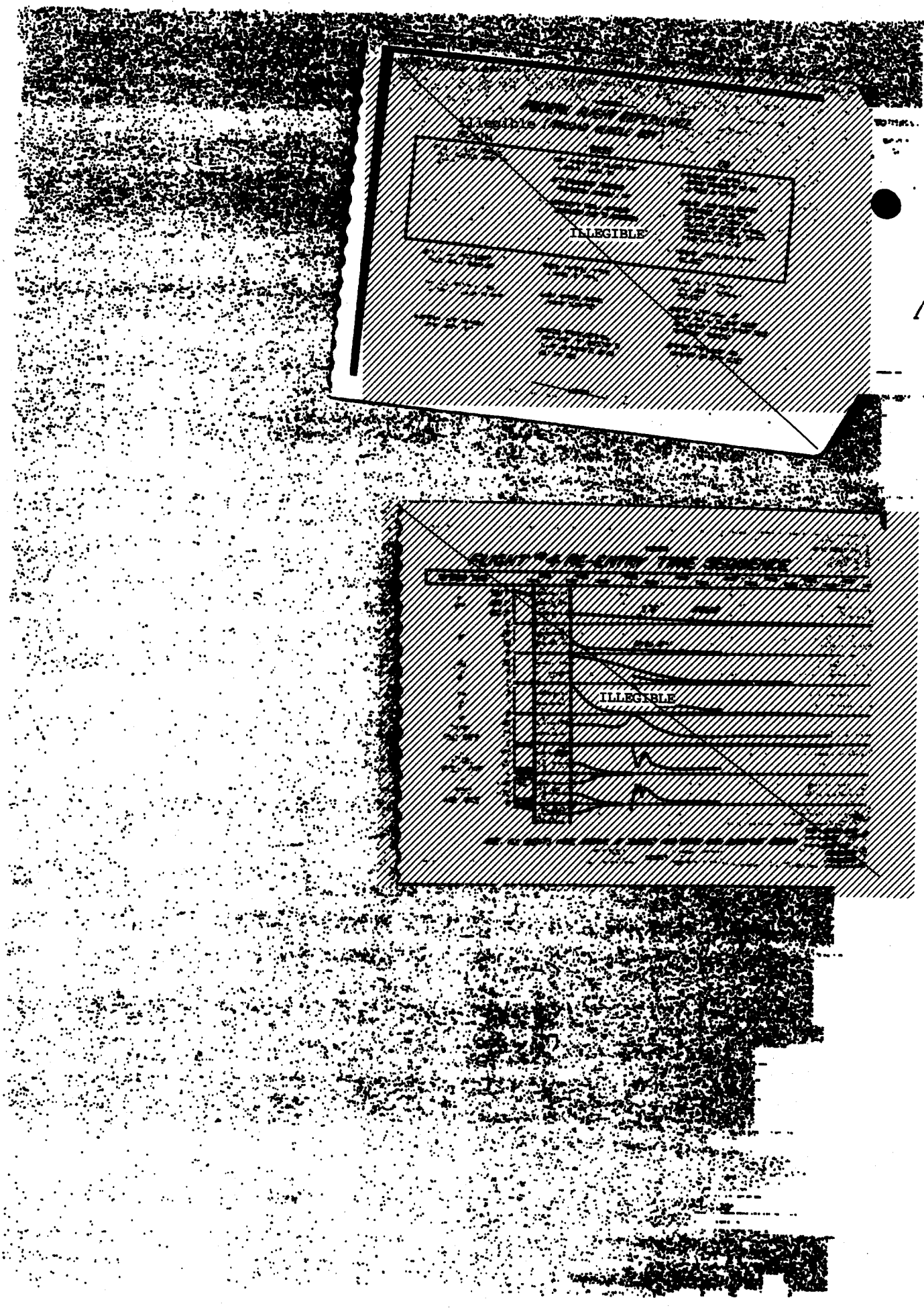


FOURTH FLIGHT EXPERIENCE
(AGENA 2404)

PROBLEM	CAUSE	FIX
GAS USAGE	UNPREDICTED TORQUES OCCURRING IN INITIAL PHASES AND DURING PAYLOAD OPERATIONS	TORQUE SOURCES UNDER INVESTIGATION — DESENSITIZATION AND CHANGE OF FLIGHT. CONTROL ELECTRONICS UNDER INVESTIGATION

FOURTH FLIGHT EXPERIENCE
(PAYLOAD FIX #4)

PROBLEM	CAUSE	FIX
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]


ILLEGIBLE
ILLEGIBLE

NOMINAL DATA

- PRE-BLACKOUT AERO-THERMO TRAJECTORY DATA
- POST BLACKOUT THERMO & PRESSURE DATA
- IMPACT

FLIGHT DATA – AERO-THERMO PROBLEMS

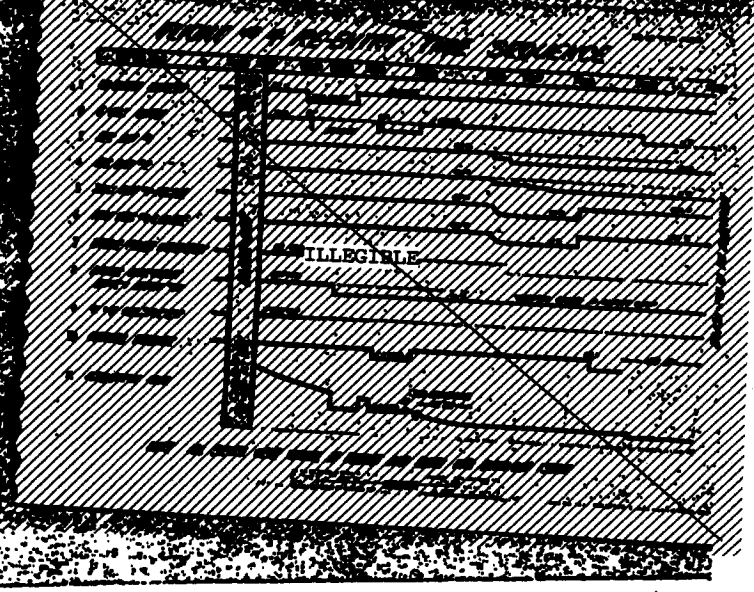
- HIGH ROLL RATE AT END OF BLACK OUT
  - SYSTEM TIME 566
- SUDDEN INCREASE THEN DECREASE IN ROLL RATE
  - SYSTEM TIME 586 - 596
- HIGH LIMIT TEMPERATURE, STATION 134
  - SYSTEM TIME 566
- INDICATED TEMPERATURE INCONSISTENCY IN HEAT SHIELD, STATION 65 & 134
- NO THERMAL & PRESSURE DATA AFTER TIME 912

MOTION ANALYSIS

- VARIATION OF AERODYNAMIC COEFFICIENTS – C_{m_q}, $C_{m_{\dot{\alpha}}}$
- VARIATION OF MASS PROPERTIES
- AERODYNAMIC SURFACE TO SIMULATE ROLL
- RYX-2 DATA

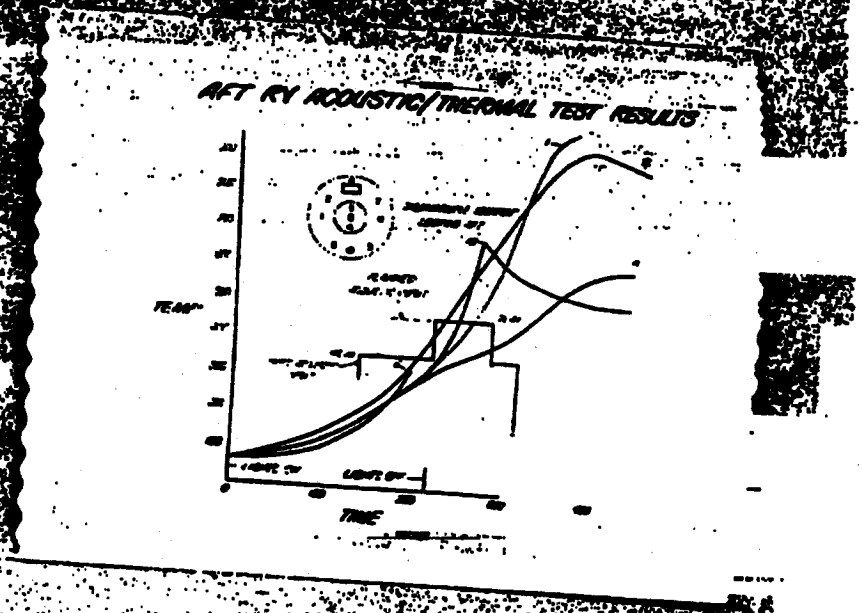
POSSIBLE AERO/THERMO DESIGN PROBLEMS

- AFT BULKHEAD HEAT PROTECTION
- THERMAL PROTECTION OF COMPONENTS IN BALLAST AREA
- ELECTRICAL CABLE NEAR EXIT OF VENT VALVE
- RE-ENTRY VEHICLE DEFLAGRATION EFFECTS



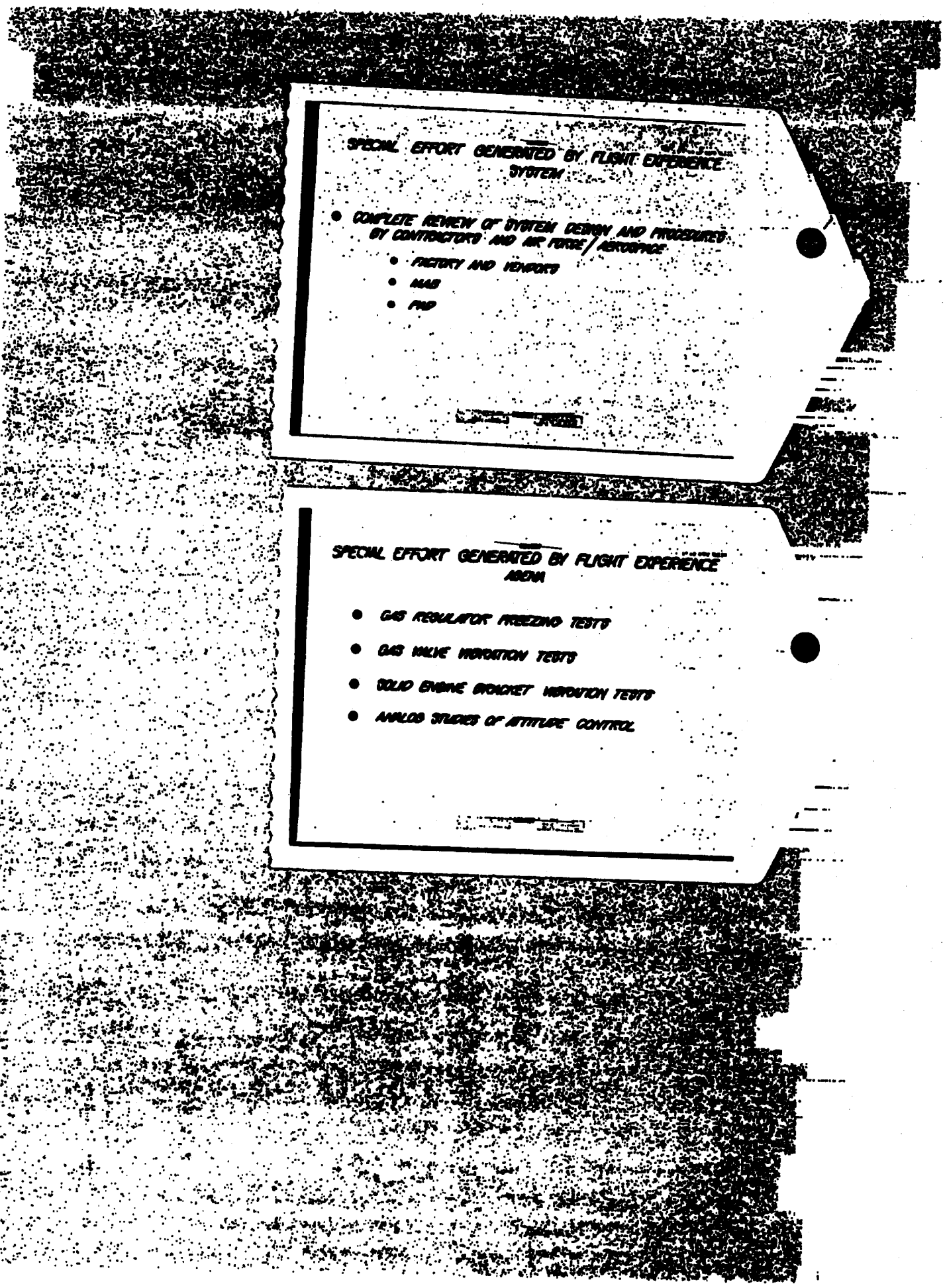
ADDITIONAL SYSTEM TESTS NEEDED PRIOR TO FLIGHT

1. ACOUSTIC/THERMAL TESTS OF AFT RV
2. RV SEPARATION - ATMOSPHERIC & VACUUM


AFT RV ACOUSTIC/THERMAL TEST RESULTS
TIME

ATLAS GUIDANCE MECHANIZATION PROBLEM

- MARINER I FAILURE INVESTIGATED
  (GUIDANCE EQUATIONS MECHANIZED TO RESPOND IMPROPERLY TO POOR DATA)
- DIFFERENT PROGRAMMING DISCREPANCY DISCOVERED FOR PROGRAM 638 BJ
  (RESULTING IN SIMILAR PROBLEM)
- INTERIM FIX IMPLEMENTED FOR FLIGHT NO. 5
  (REDUCES PROBABILITY OF FAILURE TO NEGLIGIBLE PROPORTION)
- FINAL FIX WILL BE IMPLEMENTED FOR FLIGHT NO. 6


SPECIAL EFFORT GENERATED BY FLIGHT EXPERIENCE
SYSTEM
• COMPLETE REVIEW OF SYSTEM DESIGN AND PROCEDURES BY CONTRACTORS AND AIR FORCE/AEROSPACE
• FACTORY AND VENDORS
• MAB
• PAD
SPECIAL EFFORT GENERATED BY FLIGHT EXPERIENCE
ARENA
• GAS REGULATOR FREEZING TESTS
• GAS VALVE VIBRATION TESTS
• SOLID ENGINE BRACKET VIBRATION TESTS
• ANALOG STUDIES OF ATTITUDE CONTROL

SPECIAL EFFORT GENERATED BY FLIGHT EXPERIENCE
PAYLOAD VEHICLE

- RELIABILITY UPGRADE "S" BAND REMOTE REGULATED POWER SUPPLY
  - FACTORY TESTS, EXTENDED DUTY CYCLE
  - FAILURE HISTORY
- RELIABILITY UPGRADE, DOPPLER REMOTE AND POWER SUPPLY
  - FACTORY TESTS
  - FAILURE HISTORY
- SHAKEDOWN OVERTEST OF TELEMETRY PROGRAMMER

SPECIAL EFFORT GENERATED BY FLIGHT EXPERIENCE
RECOVERY VEHICLE

- RESEARCH PROGRAM ON AERODYNAMIC AND THERMODYNAMIC HEATING
- RECOVERY SYSTEM: AEROSPACE INSPECTION, PACKING AND DEPLOYMENT TESTS (FLIGHT HARDWARE)
- LABORATORY TESTS OF NEW THERMAL COATING RTV 60 PLUS MICROBALLOON (PD-500)
  - SHOCK TESTS
  - VIBRATION
- OVEN TESTS OF PYROS SUBJECT TO WAKE HEATING
- CALORIMETER CALIBRATION TEST, FLUX RATE AND INTEGRATION

SPECIAL EFFORT GENERATED BY FLIGHT EXPERIENCE
PAYLOAD

- DETERMINATION OF ATTITUDE EFFECT ON RECORD TRANSPORT
  - INVERTED TESTS, DYNAMIC, STATIC
  - REFLECTION MEASUREMENTS AND ANALYSIS
- SPECIAL RECORD RUNS WITH COVERS REMOVED
  - HORIZONTAL
  - VERTICAL

FLIGHT 5 READINESS

- ATLAS
  HIGH CONFIDENCE THAT SUCCESSFUL BOOST WILL BE OBTAINED
- AGENA
  HIGH CONFIDENCE THAT SUCCESSFUL INJECTION/ ON-ORBIT/DEBOOST PERFORMANCE WILL BE OBTAINED
- PAYLOAD VEHICLE
- PAYLOAD
  HIGH CONFIDENCE THAT AT LEAST ONE CAMERA WILL OPERATE THROUGH MISSION

PERFORMANCE COMPARISON WITH OTHER PROGRAMS

SUBSYSTEM	PROGRAM 698BJ	OTHER PROGRAMS	REMARKS
ATLAS	100%	60%	LAST 20 ATLAS SHOTS
AGENA	50%	60%	DISCOVERER SHOTS THROUGH EJECTION
PV	75%	NO DATA AVAILABLE	
PL	61%	NO DATA AVAILABLE	
RV	INSUFFICIENT DATA	88%	DISCOVERER RE-ENTRY AND RECOVERY
C&C	≅ 100%	≅ 100%	
BEST ESTIMATE OF OVER-ALL PERFORMANCE	< 23%	< 3%	

PROPOSED SYSTEM MODIFICATIONS

TYPICAL SEQUENTIAL WEIGHT STATEMENT

[illegible] INCLINATION – ATLAS / AGENA D [illegible] FT/SEC DEBOOST

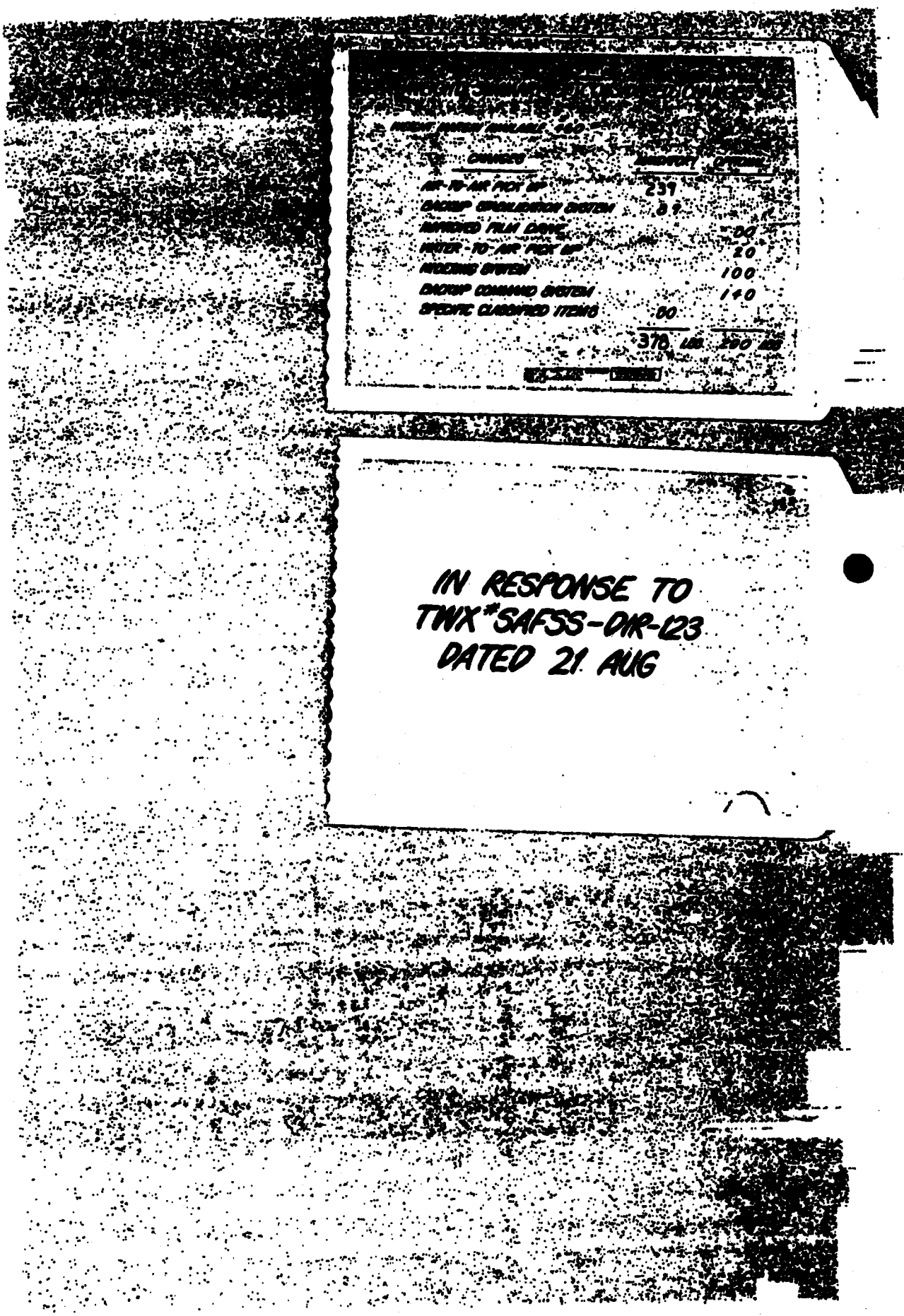
ON STAND GROSS WEIGHT	[illegible] LBS
SATELLITE VEHICLE AT SEPARATION FROM ATLAS	[illegible] LBS
SATELLITE VEHICLE AFTER FIRST BURN	[illegible] LBS
SATELLITE VEHICLE AFTER DEBOOST	[illegible] LBS
UNUSED PROPELLANTS IN ADDITION TO 3 σ MARGINS (CONVERTIBLE TO MARGINAL)	460 LBS
R.V. AFTER SEPARATION	[illegible] LBS [illegible] RECORD

PROGRAMMED SYSTEM CHANGES

- INCORPORATE AGENA D - DIRECTED
  FLT #10 AND SUBSEQUENT
- INCORPORATE INDEX SYSTEM - DIRECTED
  FLT #10 AND SUBSEQUENT (180 POUNDS) - OPTIONAL
- INCORPORATE SECONDARY COMMAND SYSTEM - INCREASED CONFIDENCE
  FLT #6 AND SUBSEQUENT (140 POUNDS)
- DELETE SECONDARY PROPULSION SYSTEM - NO ORBIT ADJUST
  FLT #10 AND SUBSEQUENT
- ADD BACKUP ATTITUDE CONTROL AND ENGINE SEQUENCING AT REBOOST - IMPROVED RELIABILITY
  FLT #12 AND SUBSEQUENT (85 POUNDS)

SYSTEM CHANGES UNDER CONSIDERATION

- INCORPORATE AIR TO AIR RECOVERY
  FLT 10 AND SUBSEQUENT (251 POUNDS).
- INCORPORATE WATER TO AIR PICKUP
  FLT 10 AND SUBSEQUENT (20 POUNDS)
- INCORPORATE TELEMETRY & TRACKING SATELLITE
  FLT 10 AND SUBSEQUENT (55 POUNDS)
- ADDITION OF VARIOUS CLASSIFIED ITEMS
  FLT 10 AND SUBSEQUENT (?30-300 POUNDS)


IN RESPONSE TO
TWX *SAFSS-DIR-123
DATED 21 AUG

FEASIBILITY OF ALTERNATE SYSTEMS

ENLARGED DISCOVERER RV (BIG D) WITH ATLAS/AGENA BOOST

PVP WEIGHT REDUCTION (FROM 3330 LB)	150 LB
LESS AGENA DEBOOST PROPELLANTS	1000 LB
NET WEIGHT GAIN FOR NEW SYSTEMS & GROWTH	1150 LB
ESTIMATED TIME TO FLIGHT	42 MOS
ESTIMATED COST	95 M ± M

CONCLUSION: ATTRACTIVE GROWTH POTENTIAL

BIG "D"

36-A

BIS D

WEIGHT BREAKDOWN

● [illegible]		
PAYLOAD FAIRING ASSY.		915.0
HEAT SHIELD ASSY.	238.5	
FOREBODY STRUCTURE	238.5	
ELECTRICAL INSTALLATION RECOVERY	269.5	
SEPARATION, THERMAL COVER		
STEERING SYSTEM	618.5	
● ADAPTER SECTION	30.0	
AFTERBODY STRUCTURE		205.0
● AFTSECTION	30.0	
STEERING EQUIPMENT		1782.0
SECONDARY COMMAND SUBSYSTEM	40.0	
● PAYLOAD VEHICLE	10.0	
RECORD		2872.0
● PAYLOAD VEHICLE WITH RECORD		344.0
● ESTIMATED WEIGHT- LESS: HEAT SHIELD		3216.0
INSERT CONE		
OTHER MISC.		700.0

FEASIBILITY OF ALTERNATE SYSTEMS (CONT'D)

AUGMENTED THOR/AGENA BOOST (THREE VERSIONS)

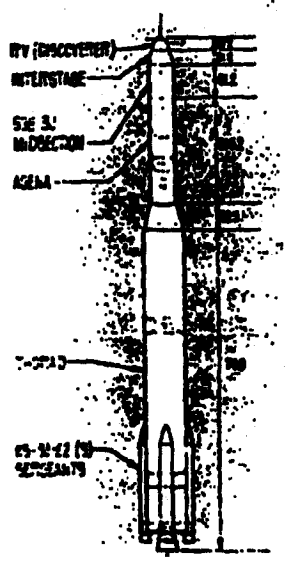
PAYLOAD CAPABILITY (WEIGHT ABOVE AGENA)

120 NM POLAR ORBIT ..... 1700 LB

WEIGHT OF CURRENT PVP AND RV

ABOVE AGENA ..... 3330 LB

WEIGHT OF BIS D WITH CURRENT PVP ..... 3130 LB



MODIFIED 698 BJ PAYLOAD ON AUGMENTED THOR / AGENA

- THE PAYLOAD FORWARD OF THE AGENA INTERFACE MUST WEIGH LESS THAN 1700 POUNDS
- A POSSIBLE PAYLOAD IS
  - EXISTING G.E. MIDSECTION
  - EXISTING E.K. STRUCTURE LESS SECTION B ASSEMBLY, RECORD B, OFF LOADING OF RECORD A
  - USE OF EXISTING DISCOVERER RV TO RETURN 111 POUNDS OF RECORD A
- REQUIRES COMPLETE PAYLOAD REPACKAGING, DESIGN OF NEW INTERSTAGE, DESIGN OF NEW TAKE UP CASSETTE, & MODIFICATION TO DISCOVERER RV TO RECEIVE RECORD
- STEREO DATA NOT OBTAINED, COVERAGE REDUCED TO ONE HALF MISSION REQUIREMENT

MODIFIED 698BJ PAYLOAD ON AUGMENTED THOR/AGENA

WEIGHT STATEMENT

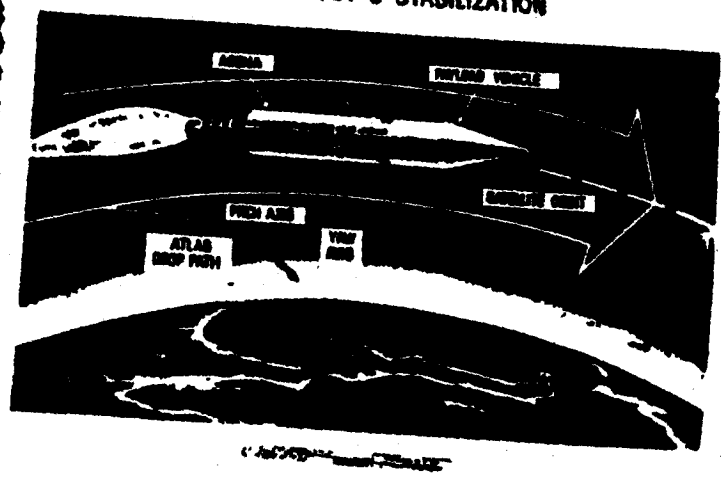
• E.K. TOTAL LAUNCH WEIGHT (M.S. ONLY)	+1249	
[illegible]	[illegible]	
[illegible]	[illegible]	
[illegible]	[illegible]	
[illegible]	[illegible]	
• PAYLOAD MIDSECTION WT (INCLUDING 111 LB RECORD)		659
• CASSETTE CHUTE & ASSOCIATED STRUCTURE IN RV		61
• G.E. MIDSECTION		565
[illegible]	[illegible]	
[illegible]	[illegible]	
[illegible]	[illegible]	
[illegible]	[illegible]	
[illegible]	[illegible]	
• INTERSTAGE (M.S. TO RV)		60
• DISCOVERER PACKAGE (STRUCT & RECOVERY SYSTEM, NO PAYLOAD)		285
• TOTAL SYSTEM WEIGHT		1630
ALLOWABLE WEIGHT		1700
RESERVE		70

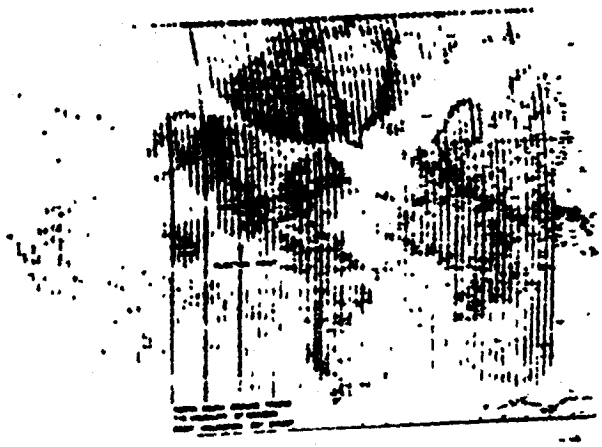
FINAL PAYLOAD CONFIGURATION

- TWO 36 INCH FOCAL LENGTH CAMERAS 100% STEREO
- CAMERAS ORIENTED NEAR HORIZONTAL
- 15 RPC SPEEDS
- CYLINDRICAL STRUCTURE
- TWO WINDOWS WITH THERMAL SHADES
- INDEPENDENT CAMERA OPERATION
- 13000 FEET OF 6 0 INCH WIDE FILM (80/32)
- SINGLE CUTTER AND SEAL

POWERED FLIGHT

ORBITAL BOOST & STABILIZATION





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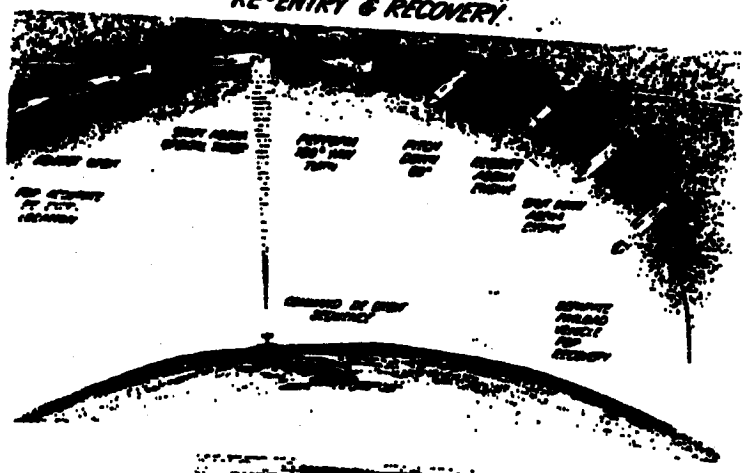
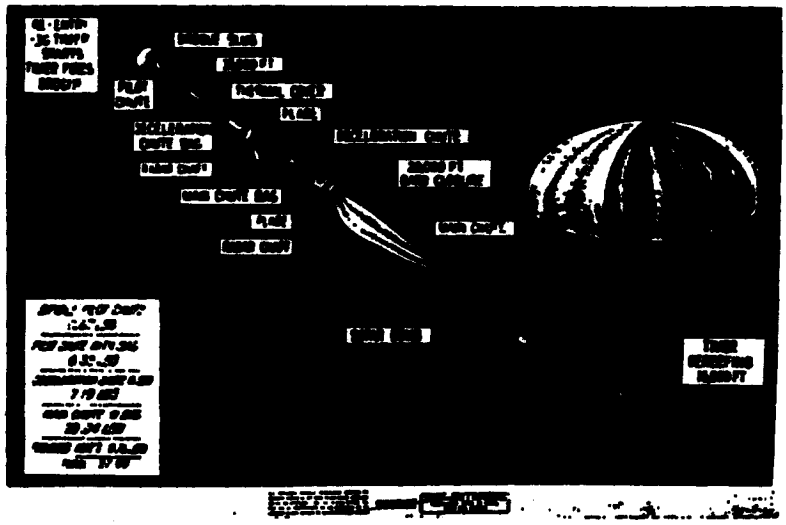
PROGRAM 698 BJ MISSION PROFILE

RE-ENTRY & RECOVERY



PROGRAM 698 BJ RECOVERY SYSTEM

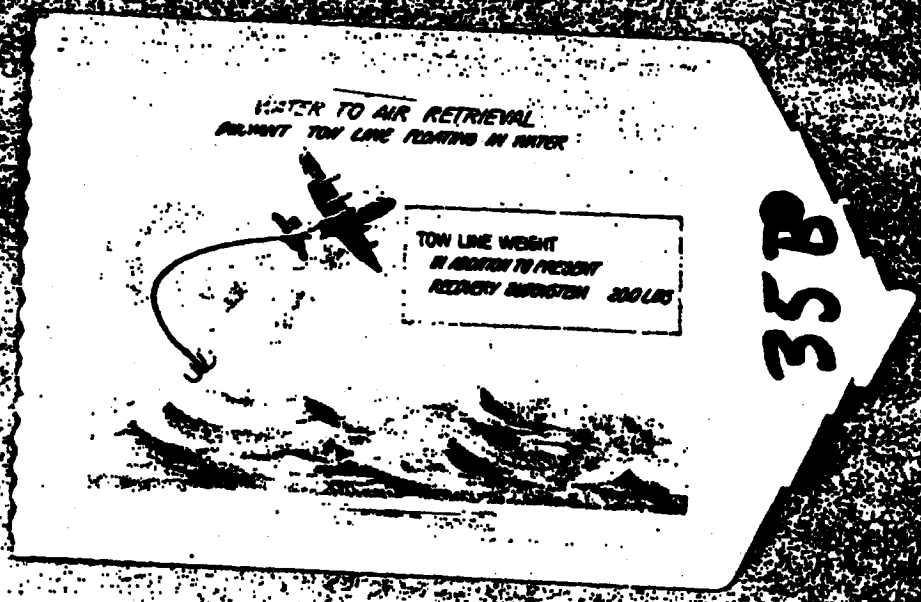


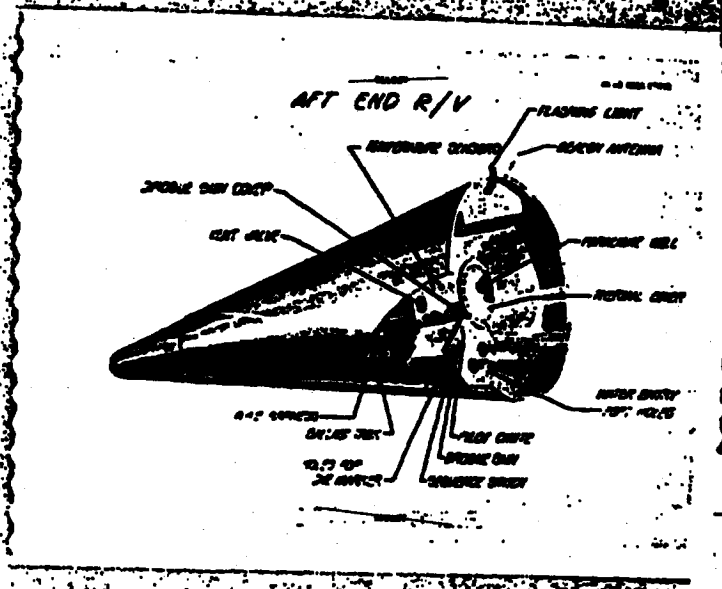
MODIFIED E-5 RECOVERY SYSTEM

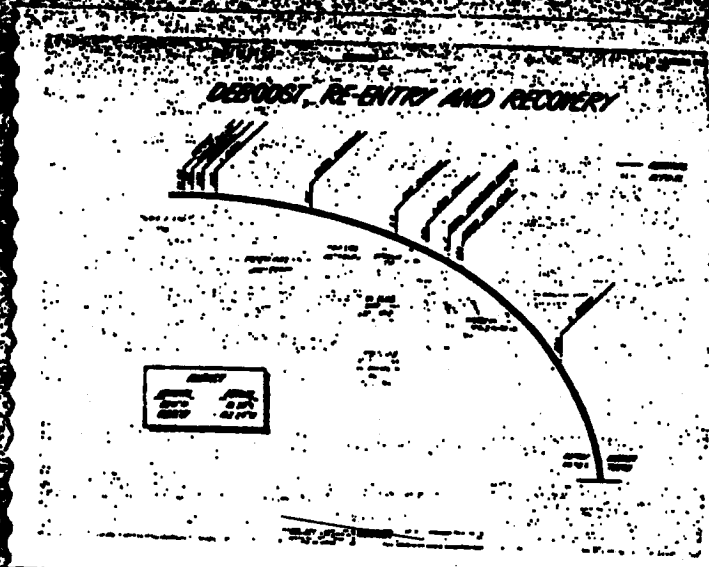
RECOVERY SYSTEM

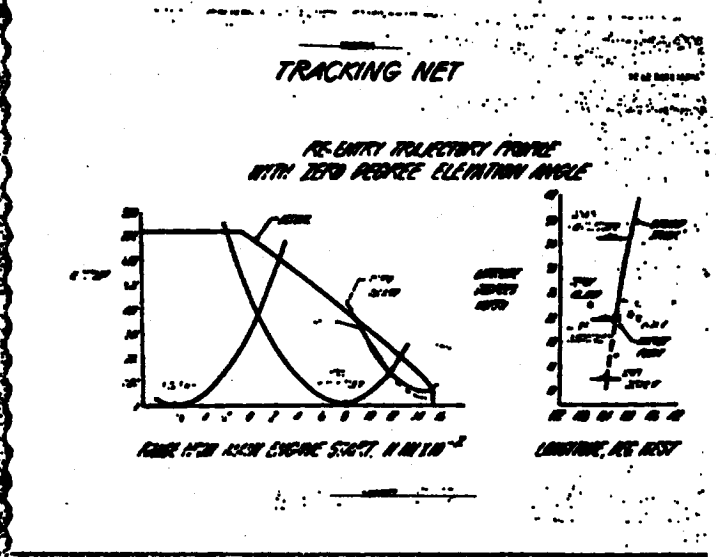
SEQUENCE OF EVENTS

COMPONENTS	ACTIVITY DEVICED	TIME (SEC)

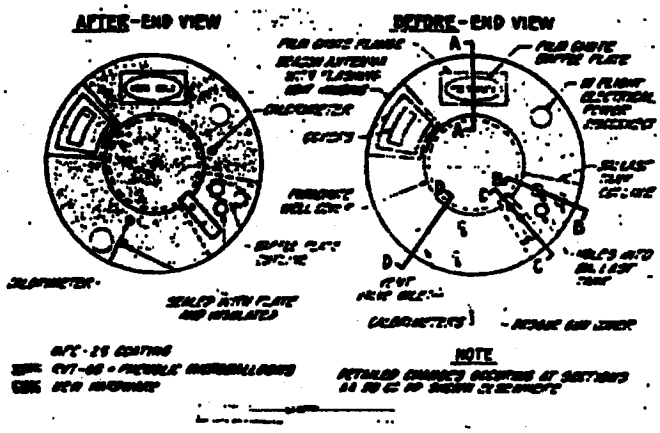

WATER TO AIR RETRIEVAL
AIRCRAFT TOW LINE FLOATING IN WATER
TOW LINE WEIGHT
35B


AFT END R/V
FLASHING LIGHT


DEBOOST, RE-ENTRY AND RECOVERY

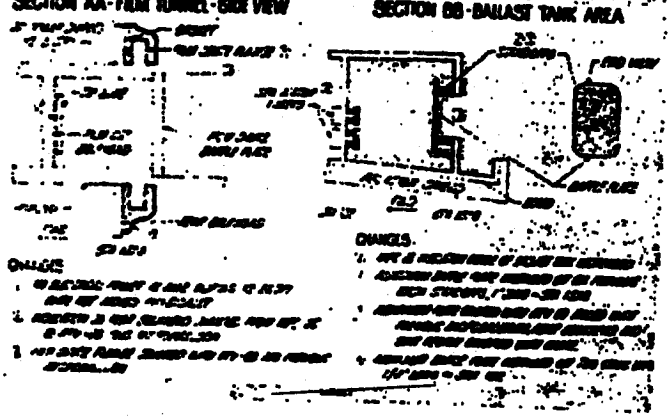

TRACKING NET
RE-ENTRY TRAJECTORY PROFILE
WITH ZERO REDUCE ELEVATION ANGLE

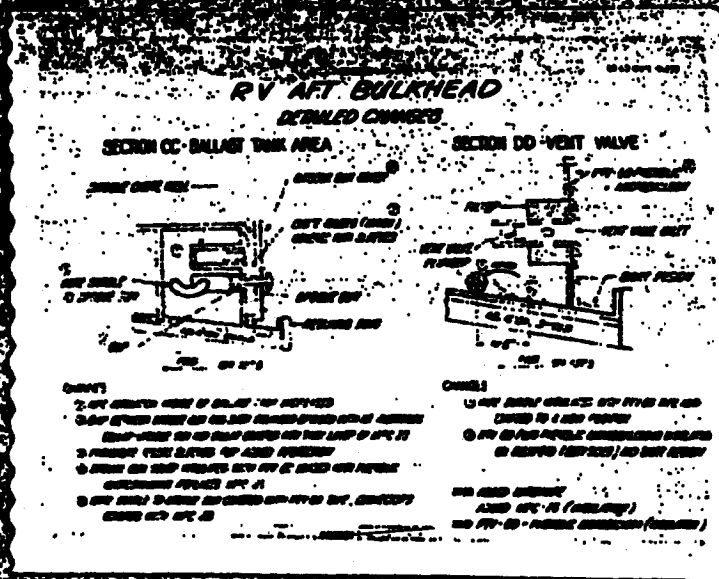
RV AFT BULKHEAD

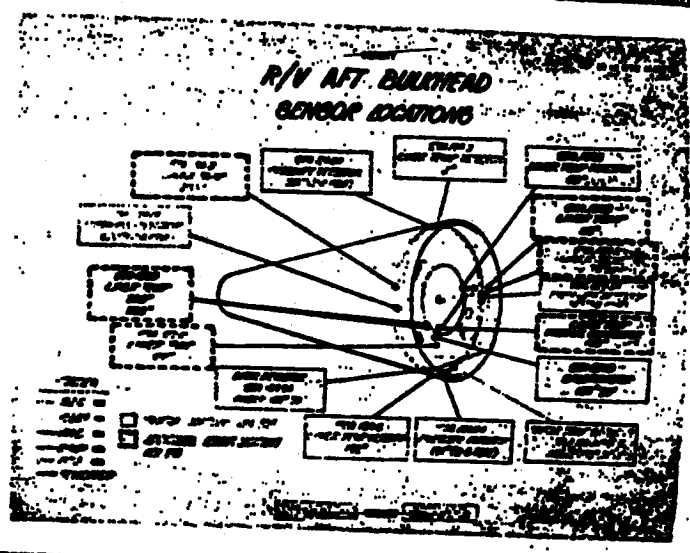


RV AFT BULKHEAD

DETAILED CHANGES




R/V AFT BULKHEAD
DETAILED CHANGES
SECTION CC - BALLAST TANK AREA
SECTION DD - VENT VALVE


R/V AFT BULKHEAD
BONDOR LOCATIONS

MODIFICATIONS TO MSFN: PREFLIGHT SYSTEMS CHECKOUT

IMPLEMENTED

- TEST ROTATION SENSOR FOR CLIPPING LEVEL
- REVISED SPECIFICATION & PROCEDURES TO OBTAIN CLEAN, DRY ATTITUDE CONTROL GAS
- REVISED ATTITUDE CONTROL SYSTEM CONDITIONING, HANDLING, & TESTING TO MORE RIGOROUS ALLOWED LIMITS OF CONTAMINATION & LEAKAGE
- REVISED SPS TESTING TO INCLUDE COMPLETE END TO END TEST

IN PROGRESS OR UNDER CONSIDERATION

- REVALIDATION OF CIRCUITS AFTER FINAL MATING
- REDUNDANCE MAIN ENGINE FUNCTIONALS & PID SIMULATED FLIGHT TEST TO ELECTRICALLY VALIDATE SYSTEM PRIOR TO LAUNCH
- REVIEW ENGINE SIMULATOR FOR CIRCUIT APTNESS
- DEVELOP PROCEDURES TO CHECK REDUNDANT CIRCUIT CLOSE

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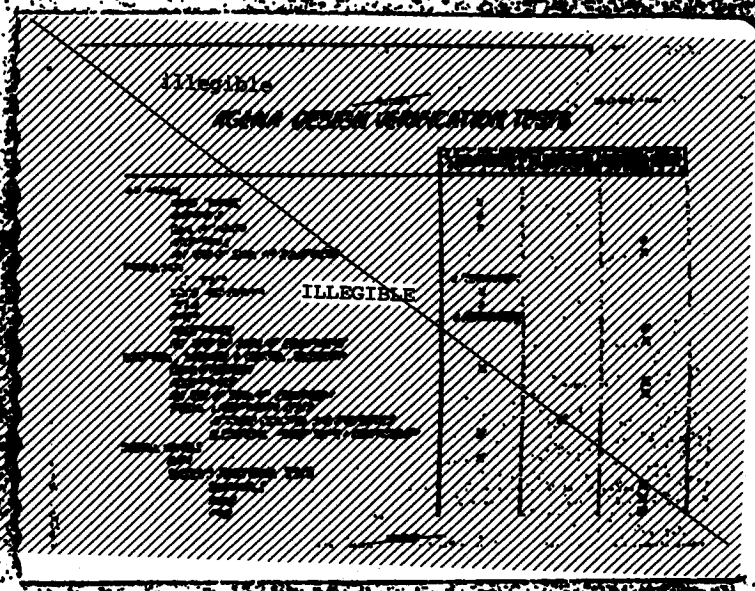
MODIFICATIONS TO PAYLOAD PREFLIGHT SYSTEM CHECKOUT

- ALL TRANSPORT LIMIT SWITCHES CHECKED FOR ADJUSTMENT
- CAPACITORS SUBJECTED TO AMBIENT-VACUUM CYCLE BEFORE INSTALLATION
- ALL RECORD TRANSPORT ASSEMBLIES POSITIVELY AUGERED AND PINNED
- SOLAR FLANGES ADDED
- SPECIAL TESTS FOR PIN #5

4. STARTING WITH 6500 FT AND SOLID FLANGES TO REDUCE RECORD DEFLECTION, THE FOLLOWING PROGRAM WAS RUN:
   (1) 1000 FT TAKE UP IN AND AGSA-PL ONLY
   (2) 3000-FT MARKED WITH PV, HORIZONTAL RUN
   (3) 000 FT MARKED WITH PV VERTICAL RUN
   (4) 6000 + MARKED WITH PV HORIZONTAL
   TRACKING VERY GOOD, NO ALIGNMENT PROBLEMS
5. FLIGHT LOAD OF 6450 FT AND SOLID FLANGES INSTALLED, PRELIMINARY ALIGNMENT TESTS ARE GOOD APPROXIMATELY 2500 FEET PER CAMERA TO BE RUN IN MAG TESTS TO CONFIRM ALIGNMENT



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